

# Carious lesions of permanent molars and oral health practices of parents and peers in Saudi male adolescents

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## ABSTRACT

**الأهداف:** دراسة العلاقة بين تسوس الطواحن الدائمة (الأول و الثاني) لدى المراهقين وممارسات الآباء والأقران المتعلقة بصحة الفم والأسنان.

**الطريقة:** أجريت دراسة مقطعية على مجموعة من المراهقين الذكور تتراوح أعمارهم بين 12-15 عاما في الدمام، المملكة العربية السعودية في فبراير 2016م. حيث تم فحص المشاركين لقياس التسوس والبلاك، كما قام المشاركون بتعبئة استبيان لتقييم الممارسات المتعلقة بصحة الفم والأسنان مثل تفريش الأسنان بمعجون يحتوي على الفلورايد، الاستعمال الحالي للتبغ، الاستهلاك اليومي من الوجبات الخفيفة والمشروبات السكرية. وقد استخدمت نماذج الانحدار اللوجستية لتحديد العلاقة بين تسوس الطواحن الأول والثاني مع ممارسات صحة الفم والأسنان لدى الوالدين والأقران.

**النتائج:** كان عدد المشاركين 294 طالبا من أصل 302 طالب تمت دعوتهم للمشاركة. ارتبط تفريش الأم للأسنان بشكل ملحوظ مع انخفاض احتمالات تسوس الطواحن الأول،  $OR=0.17$  و  $(CI\ 0.04 - 0.77)$ . ارتبط تناول الأغذية السكرية لدى الأمهات وتفريش الطلاب للأسنان بشكل كبير مع تسوس الطواحن الثاني على التوالي  $(OR=1.95\ and\ 0.36)$ ، وفترة الثقة  $(0.89 - 1.01\ and\ 9.89)$ . كان تناول الأقران للمشروبات السكرية تأثير قوي على تسوس الطواحن الثاني، لكنه غير مهم  $(OR=3.61, CI\ 0.35 - 7.44)$ .

**الخاتمة:** في المجتمع السعودي اتضح أن للأمهات تأثير كبير على تسوس أسنان المراهقين الذكور. من الضروري أن يشارك الوالدان في أي استراتيجيات متعلقة بصحة الفم للمراهقين من أجل الحد من مخاطر تسوس الأسنان الخاصة بهم.

**Objectives:** To assess the association between carious lesions in first and second permanent molars in adolescents and their parents' and peers' oral health practices.

**Methods:** This cross-sectional study of 12-15 year-old male adolescents was conducted in Dammam, Kingdom of Saudi Arabia, on February 2016. Data collection included dental examination to measure carious lesions and plaque. There was a questionnaire to assess oral health practices such as brushing with fluoridated toothpaste, current daily tobacco use, and daily consumption of sugary food and drinks. Logistic regression models assessed the association between first and second molars carious lesions with adolescents', parents', and peers' oral health practices.

**Results:** Of 302 students, 294 participated. The mother's brushing was significantly associated with a lower odds of carious lesions in the first molar (odds ratio [OR] = 0.17, 95% confidence interval [CI]: 0.04 - 0.77). The mothers' sugary food intake and students' own brushing were significantly associated with carious lesions in the second molar (OR = 1.95 and 0.36, 95% CI: 1.01-9.89 and 0.12-0.89). Friends' intake of sugary drinks had a strong, but non-significant, association with second molar's carious lesions (OR=3.61, 95% CI: 0.35 - 7.44).

**Conclusion:** In Saudi society, mothers have a major influence on their adolescent sons' carious lesions. Adolescents' oral health strategies should involve parents to reduce their risk of caries.

*Saudi Med J* 2017; Vol. 38 (7): 748-754  
doi: 10.15537/smj.2017.7.17601

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Received 9th November 2016. Accepted 8th March 2017.

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Many factors have been studied for their possible role in the development of carious lesions including oral health practices, dietary habits, socioeconomic status, and lifestyle.<sup>1-5</sup> Parental oral health practices are associated with oral health behaviors in their children and therefore with their oral health status.<sup>6,7</sup> Adolescents are likely to adopt good oral health practices (brushing, flossing, and non-sugary beverages) from their parents through modeling.<sup>8</sup> Peers may contribute to the adoption of oral health behavior such as brushing, flossing, and regular dental visits especially during adolescence where social desirability and peer pressure may lead adolescents to adopt their friends' practices including those affecting oral health.<sup>9</sup>

By early adolescence (13-15 years), the first permanent molar had been in the oral cavity for 6-7 years. During that time, it would have been exposed to the initial surge of caries attack at eruption.<sup>8</sup> This is the time when parental influence is the greatest in addition to cariogenic challenge in subsequent years. At this age, the second molar had recently erupted, and adolescents' practices begin to be affected by those practices of their peers.<sup>9</sup>

The relationship between parental and children's oral health practices has been studied.<sup>6,7</sup> However, there is a need to simultaneously compare the effect of adolescents' own practices, their parents' and that of their friends on adolescents' oral health status. In a previous study,<sup>9</sup> we described how the oral health practices of Saudi adolescents were affected by the practices of their peers to a greater extent than the practices of their parents. It would be useful to explore in the same population if the oral health (not only the practices) of adolescents is similarly affected by others' practices.

The aim of this study was to investigate the relationship between first and second molars caries in adolescents and their oral health practices as well as those of their parents and close friends. The hypothesis is that caries in the newly erupted second permanent molar will be more closely associated with adolescents' practices and those of their friends while first permanent caries molar would be more closely associated with parents' practices.

**Methods.** The current study is part of a larger cross-sectional study assessing the oral health practices among adolescents in Dammam, Eastern Province of

Saudi Arabia. The study targeted 12-15-year-old male adolescents attending middle schools (7th-9th grades) in 2016. This age group of adolescents was chosen because it represents the mid-adolescence period where first and second permanent molars are present. The Directorate of Education randomly selected 3 public schools that represented different geographic areas in Dammam. Following the cultural norms in Saudi Arabia, male examiners accessed schools of male students who were exclusively enrolled in the study. Due to lack of female examiners in this study, female schools were not accessed. Students were included if they 1) had approval from their legal guardians, 2) assented to be clinically examined, and 3) had no diagnosed medical conditions affecting their caries risk. Ethical approval was obtained from the Institutional Review Board at the University of Dammam (IRB-2015-02-187), and the study was conducted in accordance with the Declaration of Helsinki. Informed consents were delivered to the schools' principals and sent home with the students to be signed by parents or legal guardians and returned back prior to examiners' visit date.

The sample size was estimated to be 262 to 265 participants. This estimation was based on the following assumptions: relative precision of prevalence of carious lesions = 50% confidence interval, expected prevalence of carious lesions in students with favorable oral health practice = 5%, and minimum odds ratio (OR) of carious lesions = 2. All students in the schools (n=302) were invited to participate in the study to accommodate the estimated 10% non-response rate.

Data were collected using a questionnaire to assess the socioeconomic factors and oral health practices in addition to a clinical examination of carious lesions and plaque accumulation. The questionnaire consisted of 23 closed-ended questions and comprised 2 main sections. The first section assessed socioeconomic factors of parents.<sup>10-12</sup> Socioeconomic questions included participants' parents' education (university educated and higher studies versus not), mother's occupation (housewife versus working), type of residence (owned versus rented), number of bedrooms in the household, and the number of family members. The second section of the questionnaire asked adolescents to respond on a yes/no basis to questions about the respondent's, his father's, mother's and closest friend's current daily tobacco use, brushing twice daily with a fluoridated toothpaste, daily consumption of sugary food (chocolate, candies, biscuits), and sugary drinks (soft drinks, sweetened juices). The questionnaire was piloted among 30 participants and modified to ensure clarity. Those 30 responses were excluded from the sample size and final

**Disclosure.** Authors have no conflict of interests, and the work was not supported or funded by any drug company.

analysis. A public health expert also assessed the face and content validity of the questions. The study participants completed the questionnaire in school under teachers' supervision. Partially filled questionnaires with fewer than 3 missing responses were included in the analysis.

Three examiners were trained and calibrated to a gold standard examiner with acceptable inter-examiner agreement ( $Kappa \geq 0.6$ ). They performed visual clinical examination in school settings using disposable mirrors and William's manual probe (PCP10-SE, Hu-Friedy Mfg. Co. Inc., Chicago, IL, USA) under classroom daylight. The World Health Organization (WHO) criteria<sup>13</sup> were used to diagnose and record carious lesions. The Loe and Silness plaque index was used to assess plaque accumulation.<sup>14</sup>

**Statistical analysis.** Statistical analysis was performed using the IBM SPSS Statistics for Windows, Version 20.0 (Armonk, NY: IBM Corp.) at the 5% significance level. The main outcomes were carious lesions presence (cavitation level) in the first and second permanent molars. These were presented as frequencies (n) and percentages (%). Descriptive analysis of study variables was presented as means and standard deviation (mean  $\pm$  SD) for continuous variables such as age and mean number of family members/room while frequencies (n) percentages (%) were used for categorical variables such as father's and mother's education, mother's occupation, type of residency, tooth brushing twice daily using fluoridated toothpaste, current daily use of tobacco, daily snacking on sugary foods, and daily snacking on sugary drinks. Univariate logistic regression models were expressed as OR and 95% confidence intervals (CI) assessed the association of each outcome with oral health practices (brushing twice daily using fluoridated toothpaste, daily consumption of sugary food/drinks, and current daily tobacco use) of adolescents, their parents and close friends controlling for socioeconomic factors including mother's and father's education, mother's occupation, type of residency, and number of family members per room. Multivariate regression models included variables that had a strong association in univariate regression ( $OR \geq 2$  or  $\leq 0.5$ )<sup>15</sup> with the outcomes in addition to plaque adjusting for socioeconomic factors and school effect.

**Results.** Of the 302 students invited to participate in this study, 294 returned the questionnaire (including partially completed) and were examined (response rate 97.4%). The mean  $\pm$  SD age of adolescents was  $9 \pm 1.0$  years.

Table 1 shows the socioeconomic background of the study participants. More than half of the fathers (55.8%) had university or higher education while the majority of mothers (67.7%) were housewives; half of them (51.7%) had less than a university education. Approximately two-thirds of respondents (64.7%) reported living in owned houses. The mean  $\pm$  SD number of family members/room was  $1.55 \pm 0.87$ .

Table 2 shows the distribution of oral health practices among adolescents and their reports of their parents' and close friends' practices. Respondents perceived a higher proportion of their mothers and fathers to brush their teeth than their close friends (92.2%, 85.4% compared to 68.7%). However, they perceived a higher percentage of their close friends than their mothers or fathers to use sugary foods or sugary drinks. The percentage of fathers perceived to be smoking were higher than those of their close friends or mothers. Clinical examination showed that the prevalence of caries in the first and second permanent molars was 64.3% and 20.1%. The mean  $\pm$ SD plaque index was  $1.3 \pm 0.7$ .

**Table 1 -** Socioeconomic background of study participants.

Variables	Values N=294
Age, mean $\pm$ SD	14.0 $\pm$ 1.0
<b>Father's education, n (%)</b>	130 (44.2)
Less than university education	164 (55.8)
University and higher studies	
<b>Mother's education, n (%)</b>	152 (51.7)
Less than university education	142 (48.3)
University and higher studies	
<b>Mother's occupation, n (%)</b>	
Working outside home	95 (32.3)
Housewife	199 (67.7)
<b>Type of residency, n (%)</b>	
Owned	190 (64.6)
Rented	104 (35.4)
Number of family members/ room, mean $\pm$ SD	1.55 $\pm$ 0.87

**Table 2 -** Distribution of oral health practices among adolescents' parents and close friends (n=294).

Oral health practices	Teenager	Father	Mother	Close friend
Tooth brushing twice daily using fluoridated toothpaste	125 (42.5)	250 (85.4)	271 (92.2)	202 (68.7)
Current daily use of tobacco	27 (9.2)	81 (27.6)	4 (1.4)	48 (16.3)
Daily snacking on sugary foods	200 (68.0)	69 (23.5)	102 (34.7)	253 (86.1)
Daily snacking on sugary drinks	202 (68.7)	115 (39.1)	105 (35.7)	245 (83.3)

Table 3 shows that when considered simultaneously in multivariate regression, 2 factors were significantly associated with the odds of caries in the first permanent molars. Mother's brushing was associated with a lower odds of carious lesions in the first molar. Plaque accumulation was associated with higher odds of carious lesions in the first molars was 64.3% and 20.1%.

For the second permanent molars (Table 4), the respondents' own brushing was significantly associated with lower odds of carious lesions while mother's sugary food intake was associated with higher odds of carious lesions. Plaque accumulation was significantly associated with higher odds of carious lesions in the second molars.

**Discussion.** The hypotheses tested in this study was that carious lesions in the first permanent molar would be associated to a greater extent with parents' practices while lesions in the second molar would be more closely associated with adolescents' own practices and those of their close friends. Our results show that these hypotheses can be partly accepted. Mother's brushing habits had a strong association with the odds of carious lesions in the first permanent molar. There was a significant association of second molar carious lesions with the adolescent's own brushing and their mothers' snacking on sugary food. Friends' practices, on the other hand, had a non-significant association

with carious lesions in either molar. Our results are generalizable to male adolescents in societies similar to Saudi Arabia in cultural and dietary habits with modest parental educational background and teens' oral health practices that are mostly unfavorable. The results have implications for other groups including external influences such as parents in health education and preventive interventions because of their association with risk of caries in teeth erupting at different time periods of the adolescents' life.

Cultural norms and relationship with parents and peers influence the adolescents' personality and behavior.<sup>16</sup> Oral health is of special importance during adolescence. Hormonal, social, and behavioral changes place teens at a higher risk for oral diseases particularly dental caries and periodontal diseases.<sup>17</sup> The prevalence of dental carious lesions is high among children in Saudi Arabia and it is highest in adolescents.<sup>18</sup> Individuals in this age group pay less attention to oral health, avoid oral care, have poor dietary habits, and are more likely to engage in risky behaviors such as tobacco abuse.<sup>18-20</sup> These behaviors place them in a high risk subset of the community.<sup>16</sup> In our study, the association of first molar caries with mother's brushing was significant even when it was included in the same model with adolescents' own brushing. The parents' tooth brushing was reported by others to be associated with a similar habit in their preschool children.<sup>18</sup> As children grow,

**Table 3** - Relationship between caries presence in first molars and practices of teenagers, parents, and close friends.

Oral health practices	Univariate		Multivariate	
	Odds ratio (95% confidence interval)	P-value	Odds ratio (95% confidence interval)	P-value
Own brushing	0.89 (0.55 - 1.44)	0.64		
Father's brushing	0.78 (0.35 - 1.73)	0.54		
Mother's brushing	0.21 (0.05 - 0.95)	0.04*	0.17 (0.04 - 0.77)	0.02*
Friend's brushing	1.13 (0.45 - 2.84)	0.80		
Own smoking	1.10 (0.48 - 2.54)	0.83		
Father's smoking	1.35 (0.76 - 2.38)	0.31		
Mother's smoking	1.44 (0.08 - 4.05)	0.57		
Friend's smoking	1.10 (0.54 - 2.21)	0.80		
Own sugary foods	1.27 (0.76 - 2.11)	0.37		
Father's sugary foods	1.11 (0.58 - 2.11)	0.76		
Mother's sugary foods	1.06 (0.53 - 1.65)	0.82		
Friend's sugary foods	1.09 (0.46 - 2.59)	0.84		
Own sugary drink	1.61 (0.96 - 2.67)	0.07	1.89 (0.99 - 3.89)	0.06
Father's sugary drink	1.30 (0.75 - 2.25)	0.34		
Mother's sugary drink	1.59 (0.90 - 2.81)	0.11	1.19 (0.62 - 2.29)	0.60
Friend's sugary drink	0.93 (-0.56 - 1.04)	0.74		
Plaque index	1.85 (1.27 - 2.68)	0.001*	1.87 (1.18 - 2.97)	0.008*

Multivariate model includes all practices in univariate regression with odds ratio (OR)  $\geq 2$  or OR  $\leq 0.5$  and plaque adjusted for socioeconomic factors and school. \*Statistically significant at  $p < 0.05$

**Table 4** - Relationship between caries presence in second molars and practices of teenagers, parents and close friends.

Oral health practices	Univariate		Multivariate	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Own brushing	0.49 (0.28 - 1.24)	0.21	0.36 (0.12 - 0.89)	0.04*
Father's brushing	0.68 (0.29 - 1.58)	0.37		
Mother's brushing	0.65 (0.22 - 1.91)	0.43		
Friend's brushing	0.56 (0.21 - 1.46)	0.23		
Own smoking	3.11 (1.36 - 7.12)	0.007*	2.84 (0.74 - 4.67)	0.10
Father's smoking	1.98 (1.06 - 3.72)	0.03*	1.37 (0.46 - 4.08)	0.58
Mother's smoking	0.00003 (0.000005 - 0.0001)	0.99		
Friend's smoking	2.09 (0.98 - 4.49)	0.06	1.62 (0.13 - 3.03)	0.56
Own sugary foods	1.31 (0.69 - 2.47)	0.41		
Father's sugary foods	1.43 (0.67 - 3.05)	0.36		
Mother's sugary foods	1.72 (0.87 - 3.40)	0.12	1.95 (1.01 - 2.89)	0.04*
Friend's sugary foods	1.56 (0.50 - 4.84)	0.44	3.61 (0.35 - 7.44)	0.28
Own sugary drink	2.01 (1.01 - 4.00)	0.05	2.29 (0.42 - 5.43)	0.34
Father's sugary drink	1.03 (0.53 - 2.00)	0.92		
Mother's sugary drink	1.68 (0.87 - 3.22)	0.12	1.16 (0.25 - 2.34)	0.64
Friend's sugary drink	1.00 (0.40 - 2.51)	0.99		
Plaque index	2.22 (1.53 - 3.22)	<0.0001*	2.58 (1.40 - 4.74)	0.002*

OR - odds ratio, 95% CI - confidence interval. Multivariate model includes all practices in univariate regression with OR  $\geq 2$  or OR  $\leq 0.5$  and plaque adjusted for socioeconomic factors and school.  
\*Statistically significant at  $p < 0.05$

other influences affect their brushing practices and they may diverge from those of their parents.<sup>21</sup> The mother's oral health behaviors such as consumption of sugary snacks, teeth brushing habits, using fluoridated toothpaste, and smoking are associated with better oral health knowledge in children aged 8-12 years.<sup>22</sup> In our study, adolescents' reports of their parents' brushing may more accurately reflect the adolescents' brushing during earlier childhood than their reports of their own current brushing. Studies have documented the association between parental oral hygiene and young children oral health status. Mattila et al<sup>23</sup> reported that caries experience (DMFT >0) in 5 year old children was associated with mother's irregular tooth brushing (OR=2.2).<sup>23</sup> Phillips et al<sup>24</sup> reported an association between mother's poor oral hygiene and caries in 2-6 year old children (OR= 2.49).<sup>24</sup> This association was also reported in older children. Okada et al<sup>6</sup> observed that the gingival condition of mothers is indicative of their oral hygiene and was associated with carious lesions in 8-11 year old children.<sup>6</sup>

The association with mothers' brushing was still significant in our study even after adding the effect of plaque accumulation. This suggests a different mechanism that is possibly related to the use of fluoridated toothpaste during brushing as opposed to plaque removal per se. This significant association with mother's brushing was not observed with the second

molar. Okada et al<sup>6</sup> commented that mothers gradually let their children assume the responsibility for oral hygiene after they leave primary school.<sup>6</sup> This might explain the weaker association with mother's brushing in the second molars.

Our study showed that adolescents' own smoking was significantly associated with dental caries in second molar in univariate analysis. This is a result of the local effects tobacco has on oral cavity such as reduction in salivary flow that increases caries risk.<sup>25,26</sup> On the other hand, the significant association between the carious lesions in the second molar and smoking in fathers and friends can be explained by role modeling and social ties, respectively.<sup>9</sup> The mother's sugary food use was associated with caries in the second molar in our study. This agrees with Freire et al<sup>5</sup> who reported a significant although weak association between caries in 15-year-old children and their mothers' frequent consumption of unhealthy food. They showed that this association indicated an unhealthy lifestyle and recommended that mothers be included in assessing the risk of children to carious lesions as well as in behavioral interventions aiming at reducing risk.

We found no association between caries in the first molars and any of the close friend's practices. In contrast, snacking on a sugary diet had a relationship with the second molar carious lesions and showed a stronger although non-significant association. This

association can be explained by the social nature of the practice, which is shared with friends. Unlike other practices such as brushing, which is a home-care routine, or tobacco that may be socially unacceptable at this age in the conservative Saudi culture. Studies about the association of oral health practices and/or status between friends and adolescents suggest that the adolescent-peer relationship has a significant impact on the adolescents' oral health-related behaviors such as brushing frequency and eating behavior.<sup>9,27,28</sup> However, most of these studies are qualitative in comparison to studies that investigate the effect of peers on adolescents' other behavioral risk factors and/or diseases such as alcohol use, smoking, participation in organized school activities, and adiposity.<sup>29,30</sup>

Bernabe et al<sup>31</sup> reported that the influence of a special person in the adolescents' surroundings was more important to their caries experience than support from their family. Reinhardt et al<sup>32</sup> reported the results of a pilot program where peer tutoring was used among 9-year-old children to promote tooth brushing among immigrant children in Germany. The authors attributed the success of the program to overcoming cultural and communication barriers. This is an example showing the extent to which children readily adopt the oral health practices of their friends.

**Study limitations.** Our study was cross sectional and did not follow the adolescents over time to prove a shift in influence of various oral health practices as they proceed from childhood to adolescence. The difference, however, between factors associated with carious lesions in the 2 molars (first and second molars) reflect influences during different time periods namely, eruption times and length of exposure to risk factors. We included only male adolescents and therefore cannot extrapolate our findings to females who should be included in future studies.

Oral health practices of adolescents, parents, and close friends in this study were based on self-reporting of 12-15-year-old students, which, although used in previous studies,<sup>4,32,33</sup> might have introduced some bias such as a respondent effect. Due to social desirability, the study might be subject to over-reporting of favorable behaviors and under-reporting of unfavorable ones. These factors might have over- or under-estimated associations that could introduce bias to our results.

In conclusion, parental oral health practices including the mother's brushing among Saudi male adolescents were associated but not demonstrated conclusively with caries in the first permanent molar. The adolescents' own brushing was associated with

caries in the second permanent molar with strong although non-significant association with peers' dietary practices. Plaque accumulation was a significant factor associated with carious lesions in both molars. Both parents, especially mothers play an important role in adolescents' caries risk mainly through brushing and dietary habits. Acknowledging the influence of family and peers can lead to preventive programs that target these groups using health educational interventions.

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